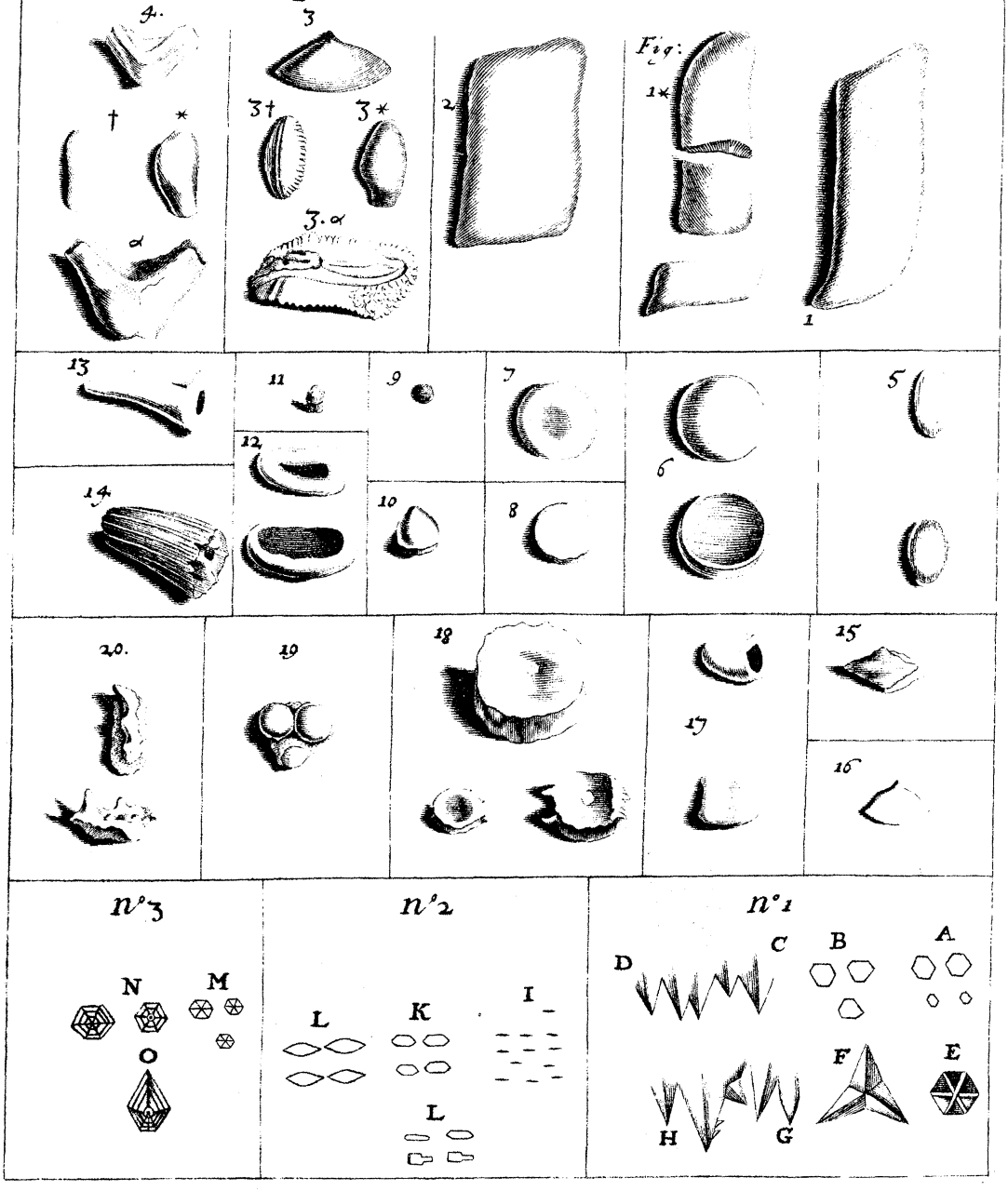
Philosophical Transactions. N°. 200



Hiſtoriam lapidum ſingulari figurâ inſignium, quos in ſua provinciâ naſci comperit; expectare juſſit.

19. Maxillæ piſcis fragmentum lapideum cum adnatis *Bufonitibus*. Garvordiæ inventum.

20. *Gloſſopetra* exigua cum mandibulæ fragmento lapideo adnato. Faringdon.

At vero ad metam inopinatò pervenimus, jam nihil amplius adjiciendi eſt locus: & te forſan diutiùs quam par eſt, hoc uno argumento detinui; quamvis gratiſſimum eſſe jamdudum comperi. Vale (vir Ornatiſſime) amicorum quacunque terrarum non immemor.

Oxonii, 20 *Aprilis*,
1693.

IV. *The Extract of a Letter from Mr.* Anthony Van Leuwenhoek, *S. R. S. to the R. Soc. containing ſeveral Obſervations on Cinnabar and Gunpowder.*

HAving with the greateſt niceneſs examined native *Cinnabar*, I could diſcover therein nothing worthy noting; wherefore I gave it a very ſtrong Fire, upon which it ſoon began to move, many ſmall Particles ſeparating themſelves from the reſt, till they had crept into a cooler place; and notwithſtanding the great Weight of the *Cinnabar*, yet ſeveral conſiderable Particles as big as Pins Heads roſe up from the Fire, and got into cooler places. When the Heat was encreas'd, the *Cinnabar* began to evaporate, a black Smoak ariſing, made up of ſmall

ſmall Globules: Examining this *Cinnabar* when cold, I found therein ſeveral ſix-ſided Figures, ſuch as is repreſented N°. 1. *A*, of which ſome were very regular, others not; they were of different ſizes, ſome of the bigneſs of a ſmall Sand, others an hundred times leſs; ſome were of the *Fig. B.* ſhaped like an Equilateral Triangle with the Three Points cut off. I never found any of theſe Figures in the *Cinnabar*, till it had been expoſed to a ſtrong Fire, which ſeparated them from it, notwithſtanding which it ſtill retained its red Colour, only was ſomewhat browner.

Some part of the *Cinnabar* that lay next to the fire appeared as *C D*; ſome Particles alſo were like *E*, others like *F*, and ſome with ſeveral Points and ſolid Angles, as *G H*. Beſides theſe Figures, there was a blackiſh matter, which like Smoak had been ſeparated from the *Cinnabar*, where I found a great number of exceeding ſmall Globules of *Quickſilver*, and admired at the great quantity thereof contained in the *Cinnabar*: Amongſt theſe Globules lay ſome, which I judged to be Salt Particles; but for their extreme minuteneſs I could not diſcern their Figure.

When I burnt the *Cinnabar* in the open Air, there aroſe a Flame very like that of *Brimſtone*; but upon examination I could not find that the inflammable parts thereof were true *Brimſtone*. Then I cauſed the Flowers of Brimſtone to ariſe, which I viewed, and found, amongſt ſeveral irregular parts, ſome Globules tranſparent like Oil; and the higher they roſe from the Fire, the ſmaller were theſe Globules, till in the end they became undiſtinguiſhable. The Volatile parts of *Cinnabar* could not be driven very high, tho' with a great Fire, whereas thoſe of *Brimſtone* were raiſed much higher with a ſmall Heat. I obſerved in the *Brimſtone* ſeveral Salt-Particles, conſtituted, as I gueſs'd, of many ſmall united Globules. For I ſuppoſe they were raiſed in a round

Figure, which ſubſiding ſhoots into Angles, eſpecially if they meet with any Moiſture.

Powdering ſome *Cinnabar*, I expoſed it to the Fire as before, and found therein ſix-ſided Figures, with ſome triangular ones, whereof ſome had one, others more Angles broken off; with other differing Figures with one acute Angle, but there were no Squares or Oblongs. I often found amongſt them a conſiderable quantity of Oil, with ſome tranſparent parts which I took for Salts; this Oil lay farthest from the Fire: and I judged the Flame which I ſometimes obſerved, might be from the burning of theſe Oily parts.

I then poured Rain-water on ſome of this *Cinnabar* that had been raiſed by the Fire without flaming; and when it had ſtood in the Air till part was evaporated, I found a great number of Salt Particles of a longiſh Figure, as are repreſented N° 2. *I.* And tho' ſome of theſe were bigger, yet I judged them to be formed of the ſmaller ones united together. Amongſt the reſt ſome were pyramidal, conſtituted on a ſix-ſided Baſis, and ending in a point like little Diamonds. There were Salts of ſome other Figures, as Oblongs, *&c.* So that no eſtimate can be made of theſe Salts. It is true Rain-Water affords a Salt, but it is in ſo ſmall a quantity as not to be conſidered in this Experiment.

Then I poured Rain-water on beaten *Cinnabar*, and after ſome Weeks ſetling, and in part evaporated, I found therein an inconceivable number of Salt Particles, of which I could not diſcern the Figures they were ſo ſmall, my beſt Microſcope ſhewing them no bigger than a Sand appears to the Naked Eye; only I fancied ſome were Sexangular. Boiling ſome of this Water, and evaporating part of it, the aforementioned Salts were to be ſeen in greater quantity; ſome of the largeſt are repreſented, magnified, N° 2. *K. L. L.*

Having

Having therefore thought that the Salt Particles which were raiſed up by the force of the Fire, muſt neceſſarily be of a Spherical Figure, as being ſoftned and melted by the Heat, I was willing to be ſatisfy'd herein; and remembring ſome Remarks I had formerly made on Gun-powder, I took ſeveral clean Glaſs Vials from 3 to 6 Inches long, theſe I heated to dry them, and rarify the Air, and then put therein one or more of the largeſt Corns of *Gunpowder*, and cloſed them up to exclude the common Air, and placed them in ſo great a Heat that the Powder took Fire, filling the Glaſs with a white Smoak, ſome of the Cole and Brimſtone ſticking to the ſides; but putting in more Corns, they were carried up much higher, ſo that I could very diſtinctly diſcern the Brimſtone from the Nitre; for it lay ſo thick in ſome places, as to exhibit a yellow colour, and might, by a good Microſcope be ſeen moving circularly in the white Smoak, which was the *Nitre*; tho the Particles thereof were very ſmall, which, when moving, appeared perfect Spheres, which leiſurely ſubſided to the bottom of the Glaſs: Wherefore I laid the Glaſs along, that the Particles of the *Nitre* might be diſtinct from thoſe of the Coal and Brimſtone; and then I found thoſe Particles which before ſeemed Globular, were, when fixed on the ſides of the Glaſs, all ſhot into ſix-ſided Salts. Some were like N°. 3. *M. N.* with others irregular as 0, and ſome of theſe ended pyramidally like little Diamonds. Some of the Salt-peter Particles which lay mixt with the others were long and ſlender, and looked like little bundles of Arrows.

Beſides the forementioned parts, I obſerved a Moiſture in the upper part of the Glaſs upon the firſt firing of the Powder, which I gueſs'd might come from the *Nitre*, and therefore ſhall call it Oyl of *Nitre*, tho' poſſibly there might be ſome Oyl of *Sulphur* mixt therewith; for further Satisfaction I put ſome refined

Nitre

Nitre by it ſelf in a Glaſs, leaving a ſmall hole in the top to prevent its burſting, and gave it ſo great a heat, that the *Nitre boyled*, and found in the upper part of the Glaſs a very tranſparent fluid matter, or Oyl, which at another time was curdled together in irregular Figures, and ſtuck to the Glaſs.

Not fully ſatisfied herewith, I repeated the Experiments with the powder, and immediately after its blowing up, I viewed the Glaſs with a Microſcope, and could then diſcern the very ſuddain change or ſhooting of the Globular Particles of the *Nitre* into Sexangular Salts, and that all at once. The number of theſe Salt-Peter Particles afforded by one Corn of Powder, is inconceivably great, beſides thoſe of the Sulphur and Coal. Theſe were beſt ſeen when I fired but one Corn; for when there were more fired, the greater quantity of *Nitre* blew up ſo much of the Sulphur and Coal, that the change and ſhooting of the Salts could not be ſo well ſeen. If I fired the Powder with Heat from below, the Coal and Sulphur would be blown up; but if with Heat from above, but few Particles of the Coal, and yet fewer of the Sulphur would be forced up.

Next I fired one, two, and three Corns of Powder in ſeveral cloſed Glaſſes, and ſuffering them to cool, I opened them (ſome after 4 or 5 days) and found always compreſt Air therein, which flew forcibly out. That I might know the quantity of this generated Air, I opened ſome of them after ſuch a manner, that the Air contained therein iſſued into a Bolt-head with a narrow Neck, which was filled with Water, which, as the Air ruſhed in, was forced out; by which Experiment I found the Air compreſs'd eight times what it was before; or, which is the ſame thing, when at liberty took up eight times the room it did before.

Not

Not fully ſatisfied herewith, I put one Corn of Powder in a Glaſs, and cloſing it up with a very ſmall hole only at the narrow end, which end I placed under the Water in the glaſs Veſſel as before, and firing the Powder, ſo great a quantity of Air was thereby generated, as forced out 160 Grains of Water. Now 13 Corns of Powder weigh but one Grain; wherefore multiplying 160 by 13, which makes 2080, we find that Gunpowder fired expands it ſelf 2080 times, or takes up ſo many times the Space it did before.

I obſerved likewiſe that the Glaſs wherein the Powder was fired would be always filled half full of Water immediately after the Exploſion, the reaſon of which I conceived to be the great rarefaction of the Air, by the Heat of the Fire and ſtroke of the Powder, which upon cooling takes up leſs Space, and the Water enters in to fill up the reſt to prevent a Vacuity.

From this laſt Obſervation, I concluded that a Bullet cannot be ſhot with ſo great a Force out of a very long Canon, or other Gun, as out of one ſomething ſhorter: And diſcourſing ſince with a certain Commander upon this Subject, he told me he was once preſent when upon a Wager a Cannon of 14 Foot threw a Ball much farther than one of 18 Foot.

As to the Reaſon, how ſo great a quantity of Air comes to be generated, tho' I thought of ſeveral Solutions, yet I could not ſatisfie my ſelf; I ſometimes thought that the Particles of the Air were by the violent motion broken and comminuted into ſmaller, and ſo between each Particle a much finer Subſtance might be placed, but this did not anſwer ſo great an Expanſion. Upon the whole, I concluded that the greateſt Improvement that can be made in ſhooting, is, if poſſible, ſo to order the matter, that all, or the greateſt part of the Powder be fired at once; and when this is effected, a much leſs quantity will ſerve than is now uſed.

To examine yet farther this matter of new-made Air, I took one Grain weight of Crabs Eyes, to which I poured Wine Vinegar, and in 4 hours as much Air was generated as filled the ſpace of 44 Grains of Water; and 3 Grains of Crabs-Eyes produced about three times as much. This new-made Air kept its Expanſion for 12 hours that I obſerved it, whence it appears to have been true Air.

V. *The Deſcription of the* American Tomineius, *or Humming Bird, communicated by* Nehemiah Grew, *M. D. and Fellow of the Royal Society.*

THere is in moſt parts of *America* a Bird called by the *Engliſh* the *Hum-Bird*, by the *Spaniard Tomineius*. He is of a moſt excellent ſhining green Color, and very reſplendent; the Colour doth ſomething reſemble ſome of our *Engliſh Drakes-heads*. It doth inhabit in ſome of the colder parts of *America*, as well as in the hotter. It is the leaſt of all Birds that I have ſeen there or in *England*; her Leg and Foot together is but half an Inch, the other parts anſwerable, the Trunk of her Body not an Inch. I did weigh one (in thoſe parts) as ſoon as ever it was kill'd, whoſe Weight was the tenth part of an Ounce *Avoirdupoize*, which I take to be about the Weight of a Coined Six-pence. And I have weighed here in *England* a *Tit-mouſe* (which I take to be the leaſt Bird here) and it weighed above Two Shillings, and ſome Half a Crown. I ſaw one of their Neſts made of Cotton-Wool, in form and bigneſs of the Thumb